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Pseudobaeospora deckeri sp. nov.— a new agaric from central California

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Abstract — *Pseudobaeospora deckeri* is described from the central California coast. This new species is characterized by fruitbodies with deep purple to lilac tones, a pileipellis with irregularly shaped erect elements, an undifferentiated subpellis, absence of cheilocystidia, and strong alkaline-virescent reactions in the pileus subpellis and stipe context.

Key words — *Agaricales,* biodiversity, fungal taxonomy, Coast Redwood, Monterey Cypress

Introduction

The genus *Pseudobaeospora* Singer has recently undergone a generic revision, spurred by the recognition and description of many new taxa (Bas 2002, 2003). Following this revisitation, novel *Pseudobaeospora* species were discovered in Europe and California (Adamčík & Bas 2002, Desjardin 2004, Vellinga 2009). Two of the more recently described species are from the central coast of California: *P. stevensii* Desjardin (Desjardin 2004), from cypress and redwood habitats in Marin and San Mateo counties, and *P. aphana* Vellinga (Vellinga 2009), from Marin County. Considered with *Tricholoma microsporum* (Ellis) Sacc. (not yet formally assigned to *Pseudobaeospora*), these species represent the second and third *Pseudobaeospora* species reported from California and the fifth and sixth species reported from North America.

Following a cold precipitation event in March of 2009, many redwood-associated macrofungi (*Hygrocybe* spp., *Entoloma* spp.) fruited on the University of California Santa Cruz (UCSC) campus. While surveying this assemblage, I encountered a small purple agaric for which the generic disposition was not immediately obvious. While investigating the fruitbodies closely, I collected a range of representative specimens in January 2010, when the same mycelium produced over forty fruitbodies. In December 2010, while surveying macrofungi of the California coast with Erin Page Blanchard and Noah Siegel, I collected

specimens from two additional, relatively distant, sites on the central California coast. A striking member of the Central California mycobiota, *P. deckeri* represents the fourth described species of *Pseudobaeospora* in California and the seventh in North America.

Materials & methods

The macromorphology was described from fresh material. Micromorphological features were observed from both fresh and dried material. Standardized color notations were made using Kornerup & Wanscher (1984). Specimens were sectioned using a Nikon SMZ-10A dissecting microscope and mounted in 3% KOH with and without staining by aqueous Congo Red or Melzer's reagent. Micromorphological features were observed with a Nikon Eclipse E800 light microscope. Lamellae and lamellulae are denoted as L and l, respectively. Spore measurements are given with the arithmetic means denoted as $L_{avg} \times W_{avg}$. DNA was extracted with Sigma Extraction Kit- REDExtract-N-Amp Plant PCR using standard procedures; ITS1F and ITS4 primers were used for PCR reactions, and cleanup was performed with Exosap. Sequencing reactions used Big Dye v3.1 at 1/8 strength of manufacturer's instructions, on a 3730 Sequencer (Applied Biosystems, Foster City, California). The resulting sequence was edited and assembled with Sequencher 4.2.2 (Gene Codes Corp., Ann Arbor, Michigan) and deposited in Genbank (JF898319).

Taxonomy

Pseudobaeospora deckeri C.F. Schwarz, **sp. nov.** Figs 1–2

MycoBank MB 561249

Similar to *Pseudobaeospora pyrifera* but pileipellis with erect hyphae, cap and stipe with slightly different colors and KOH reactions, and without cheilocystidia.

Holotype: **USA. California**: Santa Cruz County, Santa Cruz, UC Santa Cruz, north side of Engineering 2 Building, 12 Jan 2010, CS 12Jan2010-1 (**Holotype** UCSC 7451; Genbank JF898319).

Etymology: Named in honor of Lee Decker, instructor of biology and ocean science, whose passion has inspired generations of students.

Fruitbodies collybioid, entirely rubbery-tough to fleshy and slightly cartilaginous when fresh, brittle in age, but rather persistent. Pileus 10–27 mm wide, broadly convex and circular to plano-convex or uplifted and irregularly wavy; margin of young specimens distinctly but narrowly involute and in some specimens distinctly ribbed; very finely pruinose, evenly or in zones or blotches, especially near margin, in age nearly glabrous; deep royal purple (16E–F8) when young and moist, fading to dull brownish or grayish purple (14F4–6), sometimes in age with areas of obscure orange-brown tones (5D5), at margin paler to nearly white. Flesh thin, pallid lilac to darker purple just above lamellae. Lamellae L = 22–38(50), l = 3–5, subdistant to fairly close, adnate to finely and obscurely sinuate, ventricose in age, in some specimens intervenose and transvenose, when young dull gray (8B1–2) to dull lilac (13E3),

FIG 1. *Pseudobaeospora deckeri*.
Basidiocarps. NS 14Jan2010. Photo by Noah Siegel.

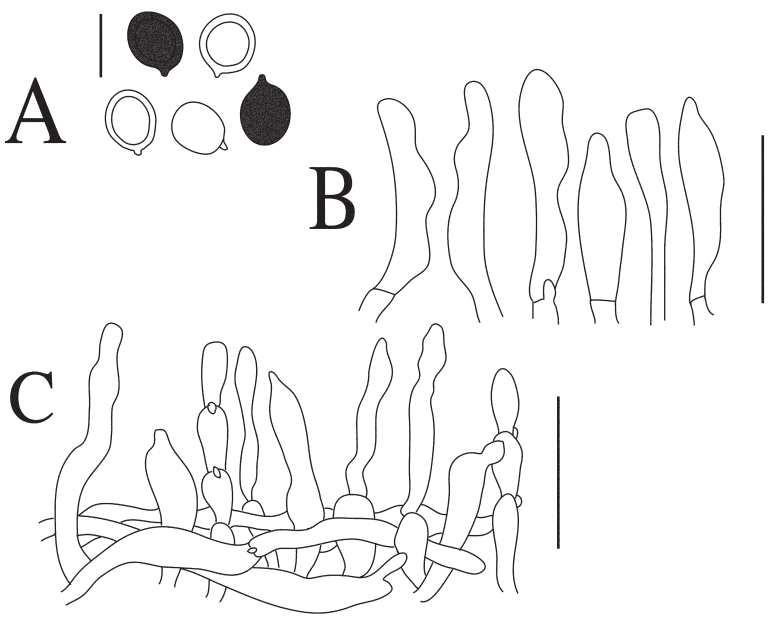

FIG 2. *Pseudobaeospora deckeri*.
A. Spores. B. Caulocystidia. C. Pileipellis. Bars: A = 3.5 µm, B–D = 30 µm.

in age distinctly ochre brownish (6C–D8); margin often thick, even to slightly irregular. Stipe (13–)29–50(–85) × 2–4.5 mm, equal or nearly so, at apex with belts or zones of fine, pale squamules, sometimes quite dense, with a fine pruina below these squamules over the upper quarter of the stipe, especially visible in young specimens, very dark purple (15F8) to royal purple (16D7–8) more or less remaining so at apex, but lower portions becoming duller purple to reddish-brown (11F7, 12D6, 12F4), at base usually conspicuously strigose, this tomentum white to lilac or purplish; base slightly rooting and bound to particles of substrate; flesh solid, dull, grayish purple, cartilaginous. Odor indistinct, although dried specimens wetted with alcohol emitted a 'mushroomy' odor (like *Agaricus bisporus*). Taste weakly but distinctly peppery or acrid. Macrochemical Reactions instantly dark blue-green in 3% KOH, this reaction obscured by the dark color of the fruitbodies and thus best detected by swabbing the treated fruitbody on white paper, or immersing a thin section in KOH. Spore Deposit white.

Basidiospores L × W = (2.8)3.6–3.8(4.8) × (2.8)3.3–3.5(3.8) µm. Q = (1.0) 1.05–1.1(1.3). A total of 40 spores from two fruitbodies were examined microscopically: i) (n = 20; from stipe apex, in Melzer's reagent) 2.8–3.8 × 2.8–4(4.8) µm, L_{avg} × W_{avg} = 3.6 × 3.3 µm, Q = 1.0–1.3, Q_{avg} = 1.1. ii) (n=20, from stipe apex, in Melzer's reagent) 2.9–4.3 × 2.9–3.8 µm, L_{avg} × W_{avg} = 3.7 × 3.5 µm, Q_{avg} = 1.05. Globose to subglobose or broadly ellipsoid, some with visible internal droplet; with conspicuous hilar appendage. Morphology and chemical characters of spores variable within a well defined range: immature spores smooth, thin or thick-walled and inconsistently dextrinoid, more mature spores dextrinoid within 5 minutes, thick-walled and smooth. Basidia 24–30 × 3.5–5 µm, clamped at base but obscurely so, tetrasporic, infrequently bisporic, protruding only slightly from lamellar face. Lamellar trama regular, composed of inflated elements 43–80 × 5–28 µm, barrel shaped and tapered at both ends, clamped. Walls irregularly and coarsely thickened. Cystidia absent, but irregularly shaped basidioles at the lamellar margin were inconsistently present. Pileipellis fundamentally a cutis of equal to slightly irregularly inflated hyphae 4.3–8.6 µm in diam., but with many erect elements, thus appearing as a trichoderm, remaining purplish in KOH; erect elements 16–58 × 3.6–6.7 µm, cylindrical to cylindrical-flexuous, often irregularly swollen, constricted or knobbed, often once or twice septate and clamped, often slightly entangled or clustered, more scattered away from disc, not encrusted. Subpellis of tightly interwoven hyphae, not or obscurely differentiated from pileal trama, distinctly green in KOH. Pileus trama parallel, made up of narrow, non-encrusted clamped hyphae. Stipitipellis at apex with a dense coating of clustered caulocystidia over a layer of narrow hyphae 2.8–5 µm in diam., attenuated over upper part of stipe. Caulocystidia 29–40 × 2.9–4.8 µm, cylindrical-flexuous

to strangulate or irregularly swollen and constricted or knobby, often once-septate and clamped; green in KOH (3%). Stipe Trama of inflated hyphae ≤ 8.6–14 µm in diam., pseudoparenchymatous in cross-section, strongly green in KOH. Clamp connections abundant in all tissues.

Ecology & distribution — Subcaespitose or scattered, terrestrial. Fruiting at the type locality amongst woodchip mulch in a landscaped area under coast redwood (*Sequoia sempervirens*). Currently known from three locations: the type locality (University of California Santa Cruz Campus, Santa Cruz Co.), Redwood Camp (Monterey Co.), and Skyline Community College (San Mateo Co.). At the southernmost known locality (Santa Cruz Co.) fruiting near huckleberry (*Vaccinium ovatum*), red alder (*Alnus rubra*), and coast redwood, while at the northernmost known locality (San Mateo Co.) fruiting in deep needle duff of Monterey cypress (*Hesperocyparis macrocarpa*). Fruiting dates include records from early December, January, and March.

Additional Collections examined: **USA. California**: Santa Cruz County, UC Santa Cruz, north side of Engineering 2 Building, 5 Mar 2009, CS 5Mar2009-7 (type mycelium); San mateo County, San Bruno, Skyline Community College, 14 Jan 2010, NS 14Jan2010-3; Monterey County, Big Sur, UC Big Creek Reserve, Redwood Camp, 13 Dec 2010, CS 13Dec2010-5.

Discussion

Pseudobaeospora deckeri is a small agaric that occurs throughout central California but probably has a wider distribution northwards. It is distinguished by its deep purple to violet pileus with a pale pinkish bloom, white spores, strong green KOH reactions, pileipellis with upright elements, frequent clamp connections, and lack of cheilocystidia.

Because of its deeply colored fruitbodies and KOH reactions, *Pseudobaeospora deckeri* shows affinity with *P. pyrifera* and *P. jamonii* in Bas' infrageneric *Pyrifera* and *Frieslandica* groups (Bas 2003). In Voto's worldwide key, *P. deckeri* could appear in either sect. *Anistoderma* Voto or sect. *Pseudobaeospora,* depending on interpretation of the pileipellis (Voto 2009). *Pseudobaeospora deckeri* can be distinguished from other members of the genus by its distinctly purple coloration combined with its alkaline-virescent reactions, a pileipellis that is an irregular cutis with abundant erect elements, abundant clamp connections, and a lack of a distinctly cellular subpellis and cheilocystidia.

In age, the fruitbodies resemble those of *P. stevensii*, with is sympatric at two of the known sites. Side-by-side comparison of such sympatric fruitbodies showed that *P. stevensii* possesses a 'yellower'-brown stipe with a coarser, paler, and generally more scurfy apex and a paler, more strongly strigose base, completely lacks violaceous tones, and shows an olive-green KOH reaction that is easily visible against the paler brown flesh. This contrasts with *P. deckeri*, in which the bluish-green color change in KOH is usually obscured by the purplish

flesh, and thus seeming blackish-vinaceous or blackish-olivaceous unless a thin section is made to reveal a solidly bright green color. Micromorphologically, *P. stevensii* has a cellular subpellis with no upright elements, cheilocystidia, and slightly more elongate spores with a higher average Q value.

Although photographs of *P. pyrifera* Bas & L.G. Krieglst. from Europe show a macroscopically similar entity, *P. pyrifera* has short broadly clavate cheilocystidia, a pileipellis of short, strongly inflated hyphae in chains, and a different KOH reaction in the stipe trama. Another European taxon, *P. jamonii* Bas et al., has a paler pileus, nearly free lamellae, and a pileipellis with scattered, broadly clavate erect elements amongst strongly inflated chains of hyphae (Bas et al. 2002). Also macroscopically similar is *P. dichroa* Bas, which has intense violet tones to the lamellae and stipe but a much paler pileus, only occasionally (then only slightly) intervenose lamellae, and a reddish-purple KOH reaction that eventually becomes yellowish-green. *Pseudobaeospora euganea* Voto has a browner pileus, a pileipellis with only scattered erect elements and a cellular subpellis, and significantly longer spores (Q = 1.14–1.45) (Voto 2009). *Pseudobaeospora cyanea* Arnolds et al. is a European species with a more intensely bluish-purple pileus, paler lamellae, a stipe with much less violet coloration, encrusted elements in the pileipellis, and significantly larger (4.0–5.5 µm × 3.3–4.0 µm) spores (Arnolds et al. 2003).

At least four other members of this genus (some undescribed) occur sympatrically, but all can be distinguished by their differently colored fruitbodies. *Pseudobaeospora aphana* produces much paler fruitbodies and smells distinctly fishy (Vellinga 2009); microscopically it is distinguished by the presence of cheilocystidia and a cellular subpellis. Species not known to occur in California include "*Pseudobaeospora pillodii*" sensu Redhead, *P. murrillii* E. Horak, *Tricholoma microsporum,* and *Agaricus fuscolilacinus* Peck, all of which lack KOH reactions and differ in other microscopic and macroscopic characters (Desjardin 2004).

The ITS sequence obtained from the type collection was aligned against that of *Pseudobaeospora pyrifera*; this comparison showed 93% identities (E-value = 0.0), clearly demonstrating generic placement but distinct species–level difference. Unfortunately, there are currently too few *Pseudobaeospora* sequences in GenBank to perform broader phylogenetic analyses.

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